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Two papers emerged from this project during the period. One major paper, "Reconstructing the Past: Category Effects in Estimation", will appear in Volume 28 of The Psychology of Learning and Motivation. A second paper, tentatively titled "Conceptual Combination for Categories with Graded Structure", is in preparation for The Psychological Review. Experiments have been conducted on estimation of the distance between spatial locations. Other experiments have examined whether categories are imposed when information is used at retrieval, or when the information is orginally encoded.

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The University of Chicago

The Department of Education

5835 South Kimbark Avenue
Chicago, Illinois 60637

April 15, 1992

TO: Dr Alfred Fregly

FROM: Larry V. Hedges

RE: AFOSR Grant Number 90-0218 (Huttenlocher/Hedges)

Enclosed you will find an additional copy of a brief report of our progress. I have asked that the narrative be FAXed to you and that a hard copy with attachments be mailed to you.

Thank you for your help and let me know if any further information is needed. My office telephone number is (312)702-1589.

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Progress Report for AFOSR Grant 90-0218

Janellen Huttenlocher and Larry V. Hedges

During this period the second major paper to emerge from this project was accepted for publication. This paper "Reconstructing the past: Category effects in estimation," will appear in volume 28 of The Psychology of Learning and Motivation, a series edited by Doug Medin. The paper is a major theoretical analysis of category effects in memory. It provides a basis for extending our original model to more complex spaces. For example we demonstrate how to use the model to determine the direction and approximate magnitude of boundary effects on bias of reports of object locations in arbitrary two-dimensional spaces. We also discuss how spatial categories may be formed inductively based on density of values and relationships among values in multidimensional stimuli.

We have also completed a second paper tentatively titled "Conceptual combination for categories with graded structure", which we are submitting to Psychological Review. This paper examines the use of bivariate density in the formation of two-dimensional categories, a principle example being spatial categories. We show that density based categories have shapes determined by the contours of the joint distribution of instances and will not usually coincide with conjoint categories formed by the formal set intersection or Venn diagram models.

A third paper, "Statistical models for reports generated from multilevel representations", is nearly complete, but has been influenced by our advances in conceptual work. We expect this

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paper to be completed by the summer.

Experimental Work

Several studies have been conducted or are currently under way to examine several aspects of our model. We comment here on two new studies that have been started since the last progress report.

Determining Distances Between Locations

Our earlier work has concerned judging the location of a single stimulus. Our model posits inexact multilevel encoding and a response process that combines information from the alternate codings to produce responses. It predicts certain types of biases in reports, which we have empirically confirmed. We have begun to consider the question of how subjects might judge the distance between two stimuli. If they judge the distance between two stimuli by reconstructing the location of each stimulus our model provides quantitative predictions of the bias in distances that should be observed.

We predict that the bias in distances should depend on the location of the dots relative to the categories in a categorized space. Two locations on opposite sides of a category boundary should be judged further apart than two locations the same distance apart within the same category, since reports are biased away from boundaries and toward the center of the category. Also two stimuli located on opposite sides of the category prototype should be judged closer together than two stimuli the same distance apart

on the same side of the prototype.

To test these predictions, we have conducted an experiment in which subjects are presented pairs of stimuli (dots in a circle), then shown one of the two stimuli and asked to report the location of the other. The stimuli are arranged into several conditions. Some dot pairs have the same angular location but a different radial location. Other stimulus pairs have the same radial location but different angular location. Some pairs overlap category (quadrant) boundaries. Other pairs are in the same category and are either both on the same side of the category prototype (with one quite near the prototype), or on opposite sides of the prototype. Analyses of this data are currently underway.

Category Imposition at Retrieval

Our model explicitly predicts category effects on estimation. We do not know if these effects arise only if the category coding is made at the time of encoding or if they can arise if the category membership is imposed at the time of retrieval when a report is generated.

To explore this hypothesis we conducted an experiment in which subjects learn two alternate categorizations of a space, one with a boundary one third of the way along the vertical dimension and the other with a boundary two-thirds of the way along the vertical dimension. The categorizations are learned in connection with attributes of stimuli (e. g., "the chickens are in the little pen on the left and the cows are in the big pen on the right").

Subjects are then shown a stimulus on a computer display and it is then removed from view. It is then identified as having one of the two attributes prior to subjects being asked to report the location of the stimulus. Collection of this data is currently underway.